In the Claims

1. A vulcanizable rubber composition comprising a copolymer rubber that is a copolymer of an unsaturated nitrile and a conjugated diene, proportioned in a range of 10 to 45 parts by weight unsaturated nitrile to 55 to 90 parts by weight conjugated diene; a plasticizer for said copolymer rubber in an amount of 1 to 30 parts by weight plasticizer per hundred parts by weight of the copolymer rubber; a filler in an amount of about 10 to about 80 parts by weight silica per hundred parts by weight of the copolymer rubber; a filler; a coupling agent in an amount from 1 to 20 parts per hundred weight of copolymer rubber, and a vulcanizing agent for the copolymer rubber in an amount of about 0.01 to about 10 parts per hundred weight of the copolymer rubber.

2. A rubber composition in accordance with claim 1, wherein the unsaturated nitrile is selected from the group consisting of acrylonitrile, methyl acrylonitrile, and mixtures thereof; and the conjugated diene is selected from the group consisting of 1,3-butadiene, isoprene, 1,3-pentadiene, and mixtures thereof.

3. A rubber composition in accordance with claim 2, wherein the unsaturated nitrile comprises acrylonitrile and the conjugated diene comprises 1,3-butadiene.

4. A rubber composition in accordance with claim 1, wherein the copolymer rubber comprises about 10 to about 30 parts by weight unsaturated nitrile and about 70 to about 90 parts by weight conjugated diene; and wherein the rubber composition further includes a coupling agent, for coupling the filler to the copolymer rubber, in an amount of about 0.1 to about 20 parts by weight coupling agent per hundred parts by weight of the copolymer rubber, and wherein the filler comprises a silica filler.

5. A rubber composition in accordance with claim 1, wherein the plasticizer is selected from the group consisting of dioctyl phthalate, dibutyl phthalate, diethyl phthalate, butyl benzyl phthalate, di-2-ethylhexyl phthalate, diisodecyl phthalate, diundecyl phthalate, diisononyl phthalate, octyl trimellitate, isononyl trimellitate, isodecyl trimellitate, dipentaerythritol esters, dioctyl adipates, dimethyl adipates, di-2-ethylhexyl adipates, diisobutyl adipate, dibutyl adipates, diisodecyl adipates, dibutyl diglycol adipates, di-2-ethylhexyl azelate, dioctyl azelate, dioctyl sebacate, di-2-ethylhexyl sebacate, methyl acetylricinoleate, octyl pyromellitate epoxidized soybean oil, epoxidized linseed oil, epoxidized octyl alcohol-fatty acid ester, adipic acid ether esters, polyether esters, polyethers, and mixtures thereof.

6. A rubber composition in accordance with claim 5, wherein the plasticizer is selected from the group consisting of dioctyl adipates, dimethyl adipates, di-2-ethylhexyl adipates, diisobutyl adipate, dibutyl adipates, diisodecyl adipates, dibutyl diglycol adipates, di-2-ethylhexyl azelate, dioctyl azelate, dioctyl sebacate, di-2-ethylhexyl sebacate, methyl acetylricinoleate, octyl pyromellitate epoxidized soybean oil, epoxidized linseed oil, epoxidized octyl alcohol-fatty acid ester, adipic acid ether esters, polyether esters, polyethers and mixtures thereof.

7. A rubber composition in accordance with claim 6, wherein the plasticizer is dibutoxyethoxyethyl adipate, and wherein the composition includes a silica filler and a carbon black filler, wherein the weight ratio of silica filler to carbon black filler is in the range of 1 to 3 parts by weight silica filler to about 2 to 4 parts by weight carbon black.

8. A rubber composition in accordance with claim 1, wherein the silica filler is a fumed silica, a precipitated silica, treated silica, or any combination thereof.

9. A rubber composition in accordance with claim 1, wherein the filler is treated with a coupling agent selected from the group consisting of a silane coupling agent, a titanate coupling agent, an aluminate coupling agent, a zirconate coupling agent, and mixtures thereof.

10. A rubber composition in accordance with claim 9, wherein the coupling agent is a silane coupling agent having a functionality capable of reaction with an OH group of the silica filler, and having a functionality capable of reaction at a double bond contained in the conjugated diene portion of the copolymer.

11. A rubber composition in accordance with claim 1, wherein the vulcanizing agent is sulfur.

12. A rubber composition in accordance with claim 1, wherein the composition is vulcanized, in sheet form, with 0.1 to 10% vulcanizing agent to have a cross-linking density that is balanced such that tensile strength, compression set, hydrocarbon swell resistance and storage modulus onset temperature are sufficient to retain the composition under compression without tearing upon repeated flexing and stretching.

13. A fabric-reinforced rubber article formed by sandwiching a fabric layer, in woven or non-woven form, between two sheets of the rubber composition of claim 1, followed by compressing said rubber sheets together, surrounding the fabric, at a temperature sufficient to vulcanize said rubber sheets together surrounding the fabric layer.

14. A fabric-reinforced rubber article in accordance with claim 13, wherein the fabric layer is a woven fabric.

15. A fabric-reinforced rubber article in accordance with claim 14, wherein the woven fabric is selected from the group consisting of nylon, polyaramide, polyester, silk, cotton and a combination thereof.

16. A fabric-reinforced rubber article in accordance with claim 15, wherein the fabric is woven from nylon 6,6.

17. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, comprising the vulcanized composition of claim 1.

18. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, wherein the rubber composition comprises the vulcanized composition of claim 2.

19. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, wherein the diaphragm comprises the fabric-reinforced rubber article of claim 13.

20. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, wherein the diaphragm comprises the fabric-reinforced rubber article of claim 13.

21. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, wherein the diaphragm comprises the fabric-reinforced rubber article of claim 14.

22. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, wherein the diaphragm comprises the fabric-reinforced rubber article of claim 15.

23. An actuator diaphragm, in sheet form or molded convolution form, operatively interconnected to structure capable of opening and closing a valve upon movement of the diaphragm in response to pneumatic pressure exerted against a major surface of the diaphragm, wherein the diaphragm comprises the fabric-reinforced rubber article of claim 16.

24. An actuator diaphragm in accordance with claim 17, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

25. An actuator diaphragm in accordance with claim 18, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

26. An actuator diaphragm in accordance with claim 19, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

27. An actuator diaphragm in accordance with claim 20, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

28. An actuator diaphragm in accordance with claim 21, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

29. An actuator diaphragm in accordance with claim 22, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

30. An actuator diaphragm in accordance with claim 23, wherein the diaphragm is compressed between a pair of flanges coated with a resin-containing coating composition and compressed sufficiently against opposed surfaces of the diaphragm to bond the plasticizer in the diaphragm to the resin contained in the flange coating composition for increased retention of the diaphragm between the opposed flanges.

31. An actuator diaphragm in accordance with claim 24, wherein the resin contained in the flange coating composition comprises a polymer or copolymer selected from the group consisting of a polyester, polyether, polyacrylic, polyurethane, latex, alkyd, epoxy, or combination thereof.

32. An actuator diaphragm in accordance with claim 31, wherein the flange coating resin is selected from the group consisting of a polyurethane, polyethylene terephthalate, polybutylene terephthalate, an alkyd resin, and an epoxy resin.

33. A method of opening and closing a valve for controlling fluid flow in a conduit comprising operatively connecting a valve plug to an actuator diaphragm comprising the rubber composition of claim 1, and providing pneumatic pressure on a major surface of the actuator diaphragm for movement of the value plug into or away from a valve seat.